PRESENT DAY LIQUID WATER ON MARS: THEORETICAL EXPECTATIONS, OBERVATIONAL EVIDENCE AND PREFERRED LOCATIONS. G. M. Martínez, N. O. Renno, H.M. Elliott and E. Fischer. Department of Atmospheric, Oceanic, and Space Sciences, University of Michigan, Ann Arbor, MI 48109.

Introduction: Liquid water is a fundamental ingredient for life. In order to understand the habitability of other planets we must first understand the behavior of water on them. Mars has large reservoirs of H_2O and is the most Earth-like planet in the solar system. Here we review the theoretical expectation, the current evidence for liquid water on Mars, and their preferred locations [1,2,3,4].

Theoretical Expectations: Pure liquid water is not stable on the surface of Mars in bulk amounts, as shown in Fig. 1. However, four different types of liquid water other than pure could currently exist on Mars: (i) monolayers of undercooled liquid interfacial water on the surface, shallow subsurface (≤1 m), and deep subsurface (≥100 m), (ii) liquid brines [4] both on the surface and the shallow and deep subsurface, (iii) melt water formed by solid-state greenhouse effect in the shallow subsurface [2], and (iv) groundwater or aquifers (possibly of liquid brines) in the deep subsurface [1].

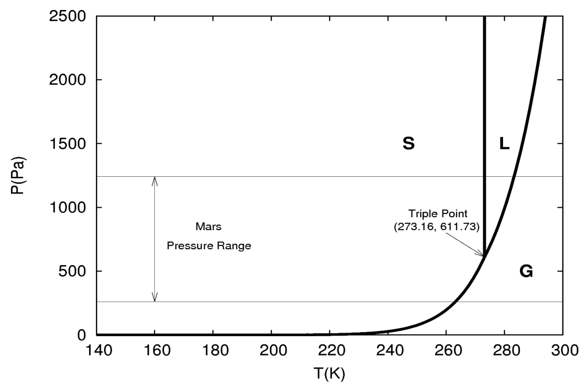

Fig 1. Phase diagram for pure water. On Mars, it can only exist in the area enclosed above the triple point and below the upper limit of the atmospheric pressure, otherwise it would boil. In this area, pure liquid water is stable against freezing and boiling, but not against evaporation. Thus, only transient events such as the melting of ice can temporarily produce pure liquid water on the surface.

Observational Evidence and Preferred Locations: Current observational evidence of liquid water on the surface of Mars is shown in the Table below.

	GULLIES	**RECURRING SLOPE LINEAE [3]**	**SLOPE STREAKS**	**SPHEROIDS AND SOFT ICE [4]**	**DUNE DARK SPOTS AND FLF [5]**
Latitude	Preferentially 30°-45° S	32°-48° S	≤40° Both hemispheres	68.22° Phoenix	≥ 77° N ≥ 54° S
Formation Time	Not certain	Spring	No pattern	Late spring	Late winter
Terrain	No pattern	Dark regions, moderate thermal inertia, and low dust index	High albedo, low thermal inertia, and high dust index	Polar plains	Polar dunes
Orientation	No pattern	Equator-facing slopes	No pattern	---	No pattern
Wet Mechanism	- Near surface ice melting - Snowpacks melting - Groundwater discharge	Briny flows from: - Groundwater Discharge -Deliquescence	Chloride and Perchlorate Brine Flow	Brines grown by deliquescence	- Liquid Brines - ULI water - Subsurface melt water
Dry Mechanism	- Lubricated CO_2 gas - Granular frosted CO_2 - Eolian material	Not given	Dust Avalanches	Contamination products	Sand and CO_2 ice cascading

Lab Experiments: Environmental conditions for brine formation is being tested in the Michigan Mars Environmental Chamber [6]. This system has been built with the intent of recreating the total pressure, water vapor pressure, and temperature present in the Mars Polar Regions.

References: [1] Martínez, G.M., et al., *Space Science Reviews* (in press, 2012), DOI: 10.1007/s11214-012-9956-3. [2] Möhlmann, D., *Icarus*, **214**, 236-239 (2011). [3] McEwen, A., et al., *Science*, **333**, 740-743. [4] Renno, N.O., et al., *JGR*, **114**, E003E03. [5] Martínez, G.M., et al., *Icarus*, **221**, 816-830 (2012). [6] Elliott, M.H., *LPSC,* abstract 2117 (2012).